NON-PUBLIC?: N
ACCESSION #: 8712240174
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Palo Verde Unit 2 PAGE: 1 of 4

DOCKET NUMBER: 05000529

TITLE: Reactor Trip Occurs During Startup Due to Axial Shape Index Out-Of-Bounds
EVENT DATE: 11/22/87 LER #: 87-019-00 REPORT DATE: 12/21/87

OPERATING MODE: 1 POWER LEVEL: 007

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: J. E. Malik, (Acting) Compliance Lead TELEPHONE #: 602-393-3527

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JC COMPONENT: CNTR MANUFACTURER: E146
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: At approximately 1940 on November 22, 1987 Palo Verde Unit 2 was in Mode 1 (POWER OPERATION) at approximately 7 percent reactor power when a reactor trip occurred as a result of the core's Axial Shape Index (ASI) being out of bounds. The trip occurred as the unit was being started up after being shutdown for approximately 40 hours. The reactor trip was uncomplicated and the Plant was stabilized very quickly terminating the event.

The root cause of the trip was a deficient procedure. The procedure did not provide adequate guidance to ensure that ASI was verified to be within bounds prior to raising power above the point that the Core Protection Calculator (CPC) (JC) shifted from a default value to a calculated value. To prevent recurrence, procedural enhancements have been implemented. Additionally, a fault contact (CNTR) in the Reactor Protection System (RPS) (JC) contributed to the event in that a reactor trip occurred on a one-of-four coincidence vice the designed two-of-four coincidence. The faulty contact was replaced and a root cause of failure was initiated to provide further analysis.

There have been no previous similar events.

(End of Abstract)

On November 22, 1987 at approximtely 1940 MST, Palo Verde Unit 2 was in Mode 1 (POWER OPERATION) at approximately 7% power when a reactor (RX) trip occurred due to a Low Departure from Nucleate Boiling Ratio (DNBR) trip signal. The DNBR trip signal was generated as a result of core's Axial Shape Index (ASI) being out of bounds. The trip occurred as Unit 2 was increasing power after being shutdown. The reactor trip was uncomplicated and the plant was stabilized within five minutes terminating the event. No Engineered Safety Features (ESF) (JE) actuations occurred and none were required.

On November 22, 1987 Unit 2 was being started up after being shutdown for approximately 40 hours. The startup was being conducted in accordance with 42OP-2ZZ04, "Plant Startup Mode 2 to Mode 1". At approximately 5% reactor power, attempts were made to monitor ASI utilizing the Core Operating Limit Supervisory System (COLSS)(IU). However, the COLSS value of ASI was not available. Concurrently, it was necessary to raise reactor power to support abnormal blowdown in order to expedite bringing steam generator chemistry to within administrative limits (Note: Steam generator chemistry being out of specification was an expected condition attributable to the earlier plant shutdown). Due to the fact that 42OP-2ZZ04 did not restrict the power ascension beyond 5% prior to verifying the ASI value, the Assistant Shift Supervisor (utility, licensed) decided to raise power enough to support the steam generator cleanup efforts. At approximately 7% power, Core Protection Calculator (CPC) (JC) Channel "B" automatically shifted from a pre-set ASI default value to a calculated value. The CPC calculated value (-0.549) exceeded the trip setpoint (-0.500 to +0.500) which resulted in a reactor trip on a one-of-four coincidence. Due to the low power level, the plant was stabilized very quickly (i.e. within 5 minutes). There were no ESF actuations as none were necessary.

The CPCs are designed to initiate automatic protective actions to assure that the specified fuel design limits on Departure from Nucleate Boiling Ratio and Local Power Density are not exceeded during Anticipated Operation Occurrences. The ASI auxiliary trip is built into the CPCs to ensure that core parameters stay within the analyzed operating space of the CPCs. Since it is not possible to derive algorithms for all possible combinations of input parameters for the CPCs, operation outside of the operating space will automatically result in a channel trip as experienced in this event.

Subsequent investigation into the abnormal ASI revealed that, at the time of criticality, the xenon concentration was approximately 43.8% of the 100% equilibrium value and at the time of the reactor trip was 38.1% of the 100%

equilibrium value. Due to the amount of xenon present and the normal startup rod position a large negative ASI (top peaked) occurred.

Additionally, a problem was identified with the Reactor Protection System (RPS) (JC) in that a reactor trip resulted from a one-of-four coincidence. The RPS is designed so that two or more channels monitoring the same parameter need to be in a tripped condition before a coincidence signal can be generated. The generation of a coincidence signal results in a reactor trip initiation signal. Troubleshooting per an approved work document to determine the cause of this problem identified a faulty contact (CNTR) in the "D" leg of the "BD" matrix logic. The contact was found to be in the open position and would not change state when its associated trip signal actuation relay (94) was energized. This deficiency in the matrix logic went undetected prior to the trip since it was only the contact which failed and not the relay. In order to have indication that a failed condition existed, the associated trip light contact must close energizing the trip light (IL). The trip light contact did not close since the trip relay did not fail. The trip light contact performed normally upon actuation of the trip signal relay. The design of the system is to "fail-safe" even with the contact malfunction. The RPS trip on a one-of-four coincidence was the result. The faulty contact has been replaced per an approved work document and a root cause of failure has been initiated to determine the cause of the faulty contact.

The root cause of this event was a procedural deficiency in that the startup procedure did not adequately provide direction to ensure that ASI was verified to be within bounds prior to exceeding 5% reactor power. Procedure 42OP-2ZZ04 required that ASI be monitored utilizing COLSS at approximately 5% reactor power. However, the procedure body did not explicitly provide an alternative to using COLSS if COLSS was not providing ASI values. It should be noted that Appendix G to 42OP-2ZZ04 provided instructions for estimating ASI in the event that COLSS ASI was unavailable; however, the procedure body did not refer control room personnel (utility, licensed) to Appendix G in the event COLSS is not providing an ASI value. Also, the procedure did not restrict the power ascension beyond 5% if ASI could not be verified utilizing COLSS.

As corrective action, 42OP-2ZZ04 was revised to provide explicit instructions to ensure that ASI is determined, either via COLSS or manually, prior to exceeding 5% reactor power. This revision was completed prior to the subsequent startup of Unit 2.

An additional concern was identified since the COLSS value of ASI should have been available for use by control room personnel (utility,

licensed). Further investigation into this problem is being conducted by Shift Technical Advisor (STA) Personnel (utility, licensed). The results of this investigation will be provided as an attachment to the Post Trip Review Report performed subsequent to the reactor trip.

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The corrective action discussed above to 42OP-2ZZ04 is considered to be adequate to ensure that ASI verification is made prior to exceeding 5% reactor power.

The data obtained by COLSS is utilized by operations personnel for information and enhancing unit performance. COLSS does not provide any safety function. Actual ASI used for safe plant operation is calculated by the Core Protection Calculator (CPC) (JC). The faulty contact in the Channel "D" RPS matrix logic malfunctioned in a conservative manner such that the reactor trip occurred on a one-of-four coincidence vice the designed two-of-four coincidence. The reactor tripped as designed and all safety functions worked properly. There were no ESF actuations. Other than described above, there were no structures, systems, or components inoperable prior to the event which contributed to the event. There were no unusual characteristics of the work location that contributed to the event. Based upon the above, this event had no impact in the health and safety of the public.

No similar reactor trips have occurred.

Component Information:

Manufacturer: Electro Mechanics, Inc.

Purchased From: Combustion Engineering

Part Model No.: 33335/ELME

ATTACHMENT # 1 TO ANO # 8712240174 PAGE: 1 of 1

Arizona Nuclear Power Project
P.O. BOX 52034 . PHOENIX, ARIZONA 85072-2034

192-00326-JGH/JEM/DAJ
December 21, 1987

NRC Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
Licensee Event Report 87-019-00
File: 87-020-404

Attached please find Licensee Event Report (LER) No. 87-019-00 prepared and submitted pursuant to 10CFR 50.73. In accordance with 10CFR 50.73(d), we are herewith forwarding a copy of the LER to the Regional Administrator of the Region V office.

If you have any questions, please contact J. E. Malik, (Acting) Compliance Lead at (602) 393-3527.

Very truly yours,
/s/ J. G. Haynes
J. G. Haynes
Vice President
Nuclear Production

JGH/JEM/DAJ/kj

Attachment

cc: O. M. DeMichele (all w/a)
E. E. Van Brunt, Jr.
J. B. Martin
J. R. Ball
R. C. Sorenson
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INPO Records Center

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